

## PRESTAGED INTERMITTING PROCESS

### FIELD OF THE INVENTION

This invention relates to intermitting, or cyclical intermittent production from a petroleum well. Intermitting is used to allow well pressure to build up between production runs, and thereby achieve sufficiently high well flow rates to remove concentrations of liquids within and around the well bore which impede production. More particularly this invention relates to a more effective method of intermitting.

### BACKGROUND OF THE INVENTION

A petroleum well will uniformly produce liquids and gases from the formation only when production exceeds a critical rate of flow. At sub-critical rates of flow liquids from the formation are not sufficiently entrained within the gas being produced. As a well ages and reservoir pressure drops, well flow rates drop into sub-critical rates. When the well produces below the critical flow rate the liquids from the formation are no longer entrained in and produced with the gas. These liquids tend to accumulate within and around the well bore and further impede production. When the well is shut down for a period of time, well pressure builds up. When the well is subsequently opened the well flow rate is higher and

better able to purge those liquids which have accumulated within and around the well bore. Liquids are also produced in the well bore due to condensation. These liquids are also not adequately produced at sub-critical rates of flow. Subsequent production is often commenced in conjunction with a plunger positioned in a bottom portion of the production tubing to more effectively purge accumulated liquids in the production tubing.

During intermitting, either with or without a plunger, a common problem is that accumulated liquids are scattered outside of the production tubing around the well bore. Consequently, when the well is opened most of these scattered liquids are not purged before well pressure and well flow drop to a sub-critical level. Subsequent production and entrainment is substantially compromised by hydrostatic forces created by these concentrations of liquids. As the well becomes older and reservoir pressure drops, the effect on production and the difficulty in purging liquid concentrations becomes more pronounced.

## OBJECTS OF THE INVENTION

It is an object of this invention to disclose a method of increasing production from an aging well in a field where reservoir pressure has dropped. It is an object of this invention to disclose a method of achieving greater production from a well, which is cycled to maintain greater pressure at the well. It is an object of this invention to disclose a method for purging accumulated liquids from within and around a well bore.

One aspect of this invention provides for a method for purging accumulated liquids from within and around a well bore comprising the steps of: shutting off the well for a period of time to allow pressure to build up; fractionally opening the well for a period of time to allow the built up pressure to cause the accumulated liquids within and around the well bore to migrate to within the production tubing of the well; and then, fully opening the well flow line to purge the collected liquids from within the production tubing.

In a preferred aspect of this method further comprises the step of positioning a plunger in a bottom portion of the production tubing prior to fractionally opening the well so that the accumulated liquids will collect above the plunger and subsequent purging will be more efficient.

Various other objects, advantages and features of this invention will become apparent to those skilled in the art from the following description in conjunction with the accompanying drawings.

## FIGURES OF THE INVENTION

Figure 1 is a cross sectional schematic view of a petroleum well.

The following is a discussion and description of the preferred specific embodiments of this invention, such being made with reference to the drawings, wherein the same reference numerals are used to indicate the same or similar parts and/or structure. It should be noted that such discussion and description is not meant to unduly limit the scope of the invention.

## DESCRIPTION OF THE INVENTION

Turning now to the drawings and more particularly to figure 1 we have a cross sectional schematic view of a petroleum well 20. Most generally, a method for purging accumulated liquids 18 from within and around a well bore 23 comprises the steps of: shutting off the well 20 for a period of time to allow pressure to build up; fractionally opening the well 20 for a period of time to allow the built up pressure to cause the accumulated liquids 18 around the well bore 23 to migrate to within the production tubing 22 of the well 20; and then, fully opening the well flow line 24 to purge the collected liquids 18 from within the production tubing 22.

Better results are obtained when the following specific steps are included in the most general method. If a flow rate measurement device 26 is positioned in the well flow line 20 the well flow 34 may be better monitored and may be timed to assess the volume of petroleum flowing from within the formation 16 into the production tubing 22. Within this

specification a flow rate measurement device is defined to include a differential pressure measurement device, which might be used to measure well flow 34. A multi-positional motorized control valve 28 in the well flow line 24 may be used to facilitate a selected fractional opening of the well flow line 24. It is additionally useful to position a pressure monitoring device 30 on the well side of the control valve 34.

To cause a required volume of liquids 18 to flow into the production tubing 22 of the well 20, it is necessary only to obtain a specified product found by multiplying the factors of flow rate and duration of time together. If the flow rate is high then the duration of time must necessarily be small so that when these factors are multiplied the required volume is obtained. For example, the well 20 may be fractionally opened so that anywhere between 50 to 150% of the critical flow rate is achieved. The duration of time the well 20 should be fractionally opened must vary inversely with the flow rate 34 during the time it is fractionally opened. Most preferably the well 20 is fractionally opened until the burst flow rate is achieved. The burst flow rate is generally considered to be 70% of the critical flow rate for entrainment of liquids 18 within gas flow. Critical flow rate for a particular well 20 may be accurately estimated by a mathematical calculation, which includes specified weighting of several factors for the particular well 20. After the burst flow rate is maintained for a predetermined time, the valve 28 is then positioned to maintain a predetermined stabilization rate of flow before the valve 28 is fully opened.

In another aspect of the invention the most general method, described above for purging accumulated liquids 18 from within and around a petroleum well 20, further comprises the step of positioning a plunger 32 in a bottom portion of the production tubing 22 prior to fractionally opening the well 20 so that the accumulated liquids 18 will collect above the plunger 32 and subsequent purging will be more efficient. After the step of positioning a plunger is added to the most general method, better results are obtained when the specific steps explained above are included in the most general method.

While the invention has been described with preferred specific embodiments thereof, it will be understood that this description is intended to illustrate and not to limit the scope of the invention, which is defined by the following claims.